

metal through-holes or a combination thereof of a bare board, and in which the substrate includes solder-mask coated areas.

36. (New) A process according to claim 18, wherein step (a) includes contacting the surface of the first metal with an aqueous composition that is free of ingredients selected from the group consisting of cyanide ions, formaldehyde, reducing sugars and combinations thereof.

REMARKS

Applicants have canceled claim 19, amended claims 1-3, 8, 14, 26-29 and 31, and added new claim 34-36. Accordingly, claims 1-18 and 20-36 are presented for examination. No new matter has been added by this amendment.

For the convenience of the Examiner, Applicants' remarks herein are set forth under appropriate subheadings.

Rejection of Claims 1-3, 8, 14, 19, 26-29 and 31 Under 35 U.S.C. §112

Claims 1-3, 8, 14, 19, 26-29 and 31 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In particular, the Action states that the term "multidentate," as used in claims 1 and 18 is unclear.

Applicants have amended claims 1 and 18 to replace the phrase "a multidentate complexing agent" with "a complexing agent that is a multidentate ligand." A multidentate or polydentate ligand is described as a bi-dentate or higher dentate ligand (Basic Inorganic Chemistry, F.A. Cotton et al., pp. 162-165, Second Edition, John Wiley & Sons, Inc., New York, NY, 1987; copy enclosed). Support for this interpretation of the phrase

“multidentate ligand” is provided in the present application which states “It is desirable to use complexing agents which are bi-dentate or higher dentate ligands since the stability constants of such complexes are higher than mono-dentate ligands.” (Present application at page 12, lines 18-21). Accordingly, reconsideration of the rejection on this ground is respectfully requested.

Claim 2 has been rejected because the Examiner states that the term “preferably” is indefinite. Applicants have amended this claim to remove this claim “preferably” and reconsideration of the rejection on this ground is respectfully requested.

Claim 3 has been rejected because the Examiner states that the phrase “a copper surface” lacks antecedent basis. Applicants have amended claim 3 to provide appropriate antecedent basis for the phrase “a copper surface.” Hence, Applicants respectfully request reconsideration on this ground.

Claim 8 has been rejected because the Examiner states that the term “the displacement coating composition” lacks antecedent basis, and because the claim is confusing. Applicants have amended claim 8 to replace the phrase “the coating composition is” with “an aqueous composition which further includes.” Therefore, reconsideration of the rejection on this ground is respectfully requested.

Claim 14 has been rejected because the Examiner states that it appears that the term “step” has been left out between the terms “to” and “(a).” Applicants have amended claim 14 to make this correction and respectfully requests reconsideration of the rejection on this ground.

Claim 19 has been rejected because the Examiner believes that the elements in the Markush group are not mutually exclusive as required. In particular, the Action states that the term “ammonia” includes ammonium ions. Applicants have canceled claim 19, so the rejection on this ground should be withdrawn. However, Applicants note that similar

Markush group language has been included in both claims 1 and 18, wherein Applicants have specifically removed the word "ammonia" because Applicants have included the term "ammonium ions." By making this amendment, Applicants wish to make it clear that claims 1 and 18 are intended to relate to embodiments in which the aqueous compositions includes either ammonia (i.e., undissociated and nonionized) or ammonium ions.

Claim 26 has been rejected because the Examiner believes that it appears that the term "° C" has been left out between the terms "15" and "2." Applicants have made this amendment to claim 26 and respectfully request reconsideration on this ground.

Claims 27 and 31 have been rejected because the phrase "40°C/93% RH" is confusing. Applicants have amended claims 27 and 31 to replace "40°C/93% RH" with "a temperature of 40° C and a relative humidity of 93%." Thus, Applicants respectfully request reconsideration on this ground.

Claims 28 and 29 have been rejected because the term "the layer of metal plating" lacks antecedent basis. Furthermore, the Action states that it is unclear whether the copper or silver metal is being plated. Applicants have amended claims 28 and 29 to replace the phrase "layer of metal plating" with "layer of silver." Hence, Applicants respectfully request reconsideration of the rejection on this ground.

Claim 31 has been rejected because the term "40°/93% RH" is unclear. Applicants have amended claim 31 to replace this phrase with "a temperature of 40° C and a relative humidity of 93%." Therefore, Applicants respectfully request reconsideration of the rejection on this ground.

The Present Invention

The present invention relates to a displacement immersion silver-plating process. (Present application at page 10, lines 1-2). A displacement plating process differs from a

electroless process because the silver coating forms on the surface of a metal by a simple displacement reaction due to the relative electrode potentials of the oxidizable metal of the surface to be protected, and of the silver ions, respectively. (Present application at page 10, lines 2-6). Surprisingly, the present invention demonstrates a method of plating by a displacement process which provides good adhesion while overcoming the problems of the prior art attempts to provide silver coatings, such as the use of ammonia which results in explosive solutions. (Present application at page 10, lines 19-24). In particular, it is a feature of the displacement process of the present invention that additional ammonia, cyanide ions, formaldehyde, thiosulphates, or reducing sugars are not required when forming a silver layer on a copper surface. (Present application at page 11, lines 19-22).

Rejection of claims 1, 3-7, 10-16 and 21-26 Under 35 U.S.C. §103 Over Greenberg

Claims 1, 3-7, 10-16 and 21-26 have been rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 3,993,845 to Greenberg et al. (Greenberg).

Claim 1 of the present application is an independent claim from which claims 3-7, 10-16 and 21-26 depend either directly or indirectly. Claim 1, as amended, recites inter alia "A process for forming a silver coating on a surface of a first metal having a first electropositivity less than any electropositivity of silver, the process comprising a step of:...contacting the surface of the first metal with an aqueous composition...free of...ammonium ions..." Therefore, the present invention as defined by claim 1, as amended, substantially relates to a process for forming a silver coating and a first surface of a first metal having a first electropositivity less than the electropositivity of silver. The process comprises a step of contacting the surface of the first metal with an aqueous composition that is free of ammonium ions.

Greenberg relates to a method of producing copper-silver films by chemical

replacement by silver of copper. (Greenberg at column 1, lines 16-18). According to the method of Greenberg, a copper-coated surface is contacted with a replacement solution containing an ammonical silver salt and a complexing agent. (Greenberg at column 5, lines 29-31). Greenberg is entirely silent regarding a method that does not include the use of ammonium ions. Furthermore, Greenberg provides no suggestion that there would be any advantage to using such a method. Hence, Greenberg does teach or suggest the method recited in claims 1, 3-7, 10-16 and 21-26 of the present application. Accordingly, Applicants respectfully request reconsideration of this rejection.

Rejection of claims 27-30 Under 35 U.S.C. §103 Over Greenberg

Claims 27-30 have been rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 3,993,845 to Greenberg et al. (Greenberg).

Claim 27 is an independent claim from which claims 28-30 depend directly. Claim 27, as amended, recites inter alia "A plated material comprising: a layer of copper having a surface; and a layer of silver plated to the surface of copper, the layer of silver having a wet time of at least 5 seconds after being exposed for 18 hours to a temperature of 40° C in a relative humidity of 93% and three reflows." Therefore, the present invention as defined by claim 21, as amended, substantially relates to a plated material. The plated material comprises a layer of copper and a layer of silver that is plated to the surface of the layer of copper. The layer of silver has a wet time of less than 5 seconds after being exposed for 18 hours to a temperature of 40° C and relative humidity of 93% and of three reflows.

Greenberg is described above. This reference is entirely silent regarding the wet time of any material subsequent to being exposed for any period of time at 40° C in a relative humidity of 93%. Moreover, Greenberg is silent with respect to reflows. Hence, Greenberg does not teach or suggest the plated material recited in claims 27-30 of the

present invention, and reconsideration of this rejection is respectfully requested.

Rejection of claims 31-33 Under 35 U.S.C. §103 Over Greenberg

Claims 31-33 have been rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 3,993,845 to Greenberg et al. (Greenberg).

Claim 31 is an independent claim from which claims 32 and 33 depend directly. Claim 31, as amended, recites inter alia "A plated material comprising: a layer of copper having a surface; and a layer of silver plated to the surface of the layer of copper, the layer of silver having a wet force of greater than 0.2 after 2 seconds immersion and storage for 18 hours at a temperature of 40° C and a relative humidity of 93%." Therefore, the present invention as defined by claim 31, as amended, substantially relates to a plated material that comprises a layer of copper and a layer of silver plated to the surface of the layer of copper. The layer of silver has a wet force of greater than 0.2 after 2 seconds immersion and storage for 18 hours at a temperature of 40° C and a relative humidity of 93%.

Greenberg is described above. This reference is entirely silent regarding the wet force of any material subsequent to being exposed for any period of time at 40° C in a relative humidity of 93%. Hence, Greenberg does not teach or suggest the plated material recited in claims 21-33 of the present invention, and reconsideration of this rejection is respectfully requested.

Rejection of Claims 2, 17 and 21-26 Under 35 U.S.C. §103 Over Greenberg
In View of Applicants' Admitted State of The Art

Claims 2, 17 and 21-26 have been rejected under 37 U.S.C. §103 as being unpatentable over Greenberg in view of Applicants' admitted state of the art.

Each of claims 2, 17 and 21-26 depend from claim 1. These claims are discussed above. Furthermore, Greenberg is discussed above where it is demonstrated that this reference does not anticipate or render obvious claims 2, 17 or 21-26.

Applicants admit that the state of the art teaches that it is well known to use silver coating on copper substrates for protecting the copper from oxidation with use of masks. (Present application at page 1, line 8-9, line 26). However, Applicants further note that the various problems associated with known methods of protecting copper from oxidation by using silver coatings. (Present application at page 1, line 8-9, line 26). Thus, the characterization of the prior art made in the present application does not teach or suggest the methods defined by claims 2, 17 or 21-26 of the present application.

Neither Greenberg nor the admitted state of the art of the present application, alone or in combination, teach or suggest the methods recited in claims 2, 17 or 21-26 of the present application. There is no suggestion to combine Greenberg and Applicants' admitted state of the art to produce such methods. Furthermore, even if Greenberg were combined with Applicants' admitted state of the art, the result would not be the methods and products of the present application. Instead, in stark contrast to the methods defined by claims 2, 17 and 21-26 of the present application, the resulting methods would include the use of ammonium ions. Therefore, reconsideration of this rejection is respectfully requested.

Rejection of Claim 18 Under 35 U.S.C. §103 Over Greenberg

In View of Applicants' Admitted State of The Art

Claim 18 has been rejected under 37 U.S.C. §103 as being unpatentable over Greenberg in view of Applicants' admitted state of the art.

Claim 18 of the present application is an independent claim. Claim 18, as amended, recites inter alia "A process for producing a bare printed circuit board comprising steps of: ...contacting the metal surface with an aqueous composition...free of... ammonium ions..." Therefore, the present invention as defined by claim 18, as amended, substantially relates to a process for producing a bare printed circuit board. The process comprises contacting the metal surface with an aqueous composition that is free of ammonium ions.

Greenberg and Applicants' admitted state of the art are described above where it is demonstrated that neither Greenberg nor the admitted state of the art of the present application, alone or in combination, teach or suggest a method that includes contacting a metal surface with an aqueous solution that is free of ammonium ions when producing a bare printed circuit board. There is no suggestion to combine Greenberg and Applicants' admitted state of the art to provide the method of claim 18. Furthermore, even if Greenberg were combined with Applicants' admitted state of the art, the result would not be the methods and products of the present application. Instead, in stark contrast to the methods defined by claim 18 of the present application, the resulting methods would include the use of ammonium ions. Therefore, reconsideration of this rejection is respectfully requested.

Rejection of claims 27-30 Under 35 U.S.C. §103 Over Greenberg

In View of Applicants' Admitted State of The Art

Claims 27-30 have been rejected under 37 U.S.C. §103 as being unpatentable over Greenberg in view of Applicants' admitted state of the art.

Claims 27-33 are discussed above. Moreover, Greenberg is discussed above where it is shown that this reference does not anticipate or render obvious claims 27-30 of the present application.

Applicants' admitted state of the art are described above. Applicants' admitted state of the art is silent with respect to the wet time or wet force of any materials. Thus, neither Greenberg nor the admitted state of the art of the present application, alone or in combination, teaches or suggests the materials defined by claims 27-30 of the present application. There is no suggestion to combine Greenberg and Applicants' admitted state of the art to provide such materials. Furthermore, even if Greenberg were combined with Applicants' admitted state of the art, the result would not be the materials recited in claims 27-33. Therefore, reconsideration of this rejection is respectfully requested.

Rejection of claims 31-33 Under 35 U.S.C. §103 Over Greenberg

In View of Applicants' Admitted State of The Art

Claims 31-33 have been rejected under 37 U.S.C. §103 as being unpatentable over Greenberg in view of Applicants' admitted state of the art.

Claims 31-33 are described above where it is demonstrated that Greenberg does not anticipate or render obvious these claims.

Applicants's admitted state of the art is discussed above. In particular, Applicants's admitted state of the art is silent with respect to the wet force of any material subsequent to being exposed for any period of time at 40° C in a relative humidity of 93%. Hence, Applicants's admitted state of the art does not anticipate or render obvious the present

invention as defined by claims 31-33.

Neither Greenberg nor Applicants' admitted state of the art, alone or in combination, teaches or suggests the materials defined by claims 31-33 of the present application. There is no suggestion to combine Greenberg and Applicants' admitted state of the art to provide such materials. Furthermore, even if Greenberg were combined with Applicants' admitted state of the art, the result would not be the materials recited in claims 31-33. Therefore, reconsideration of this rejection is respectfully requested

Rejection of claims 8, 9 and 20 Under 35 U.S.C. §103
As Being Unpatentable Over Greenberg In View Lahey

Claims 8, 9 and 20 have been rejected under 35 U.S.C. §103 as being unpatentable over Greenberg in view of U.S. Patent No. 4,067,784.

Claims 8, 9 and 20 each depend directly from claim 1 which is discussed above. Furthermore, Greenberg is discussed above where it is shown that this reference neither anticipates nor renders obvious claim 1.

Lahey relates to a non-cyanide acidic silver electroplating bath and an additive therefor. This reference discloses that the non-cyanide acidic silver electroplating bath contains a soluble silver salt, a thiosulfate, a bisulfate buffer, and a sulfate. (Column 1, lines 47-50). Lahey also discloses that the electroplating bath contains a buffer. (Column 2, lines 3-6). Furthermore, the bath may include certain surfactants (Column 2, lines 46-68). However, Lahey is entirely silent regarding the use of a bath that does not include thiosulfate ions. Furthermore, this reference provides no suggestion that such a bath should be used. Therefore, Lahey does not anticipate nor render obvious claims 8,9 or 10 of the present application.

Neither Greenberg nor Lahey, alone or in combination, anticipates the process described by claims 8, 9 and 10 of the present application. There is no suggestion to combine Greenberg and Lahey to provide such a process. Furthermore, even if these references were combined, the resulting process would not be one in which neither ammonium ions and thiosulfate ions were used such as recited in claims 8, 9 and 20 of the present application. Thus, Applicants respectfully request reconsideration of this rejection.

Rejection of Claim 19 Under 35 U.S.C. §103

As Being Unpatentable Over Greenberg In View of Mandich

Claim 19 has been rejected under 35 U.S.C. §103 as being unpatentable over Greenberg in view of U.S. Patent No. 5,322,553 to Mandich et al. (Mandich).

Applicants have canceled claim 19 and incorporated some of the limitations of this claim into claims 1 and 18 of the present application.

Mandich relates to an electroless silver plating composition. (Mandich at column 1, lines 6-7). The plating solution disclosed by Mandich includes the redox system thiosulfate-sulfite sulfate. (Mandich at column 1, lines 46-47). This reference is entirely silent regarding the use of a plating solution that does not include thiosulfate, sulfite or sulfate. In contrast to Mandich, claims 1 and 18 of the present application recite a process which is free of thiosulfate ions. Hence, Mandich does not anticipate nor render obvious claims 1 or 18 of the present application.

CONCLUSION

In view of the foregoing remarks and amendments, Applicants believe that each of claims 1-18 and 20-34 are in condition for allowance. Reconsideration, withdrawal of the grounds for rejection and passage of the case to issue are respectfully requested.

If, upon receipt and consideration of this amendment the Examiner believes the present application is not in condition for allowance, the Examiner is respectfully requested to call Applicants' undersigned counsel at the number given below.

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